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HIGH PROTEIN RICE FLOURS

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PURPOSE

The production of high protein rice flours provides the rice industry with an opportunity for increasing the utilization of rice, introducing a new rice product that will create additional markets for rice, and establishing a greater potential for improved profits.

INTRODUCTION

Industry statistics show that the production of rice in the United States has been increasing steadily. Over 5.1 billion pound-equivalents of milled rice was produced in 1965. Approximately 3 billion pounds were exported; two-thirds as direct sales and the remainder, about 1 billion pounds, for specific Government food programs. The huge world demand for food products and the almost universal acceptance of rice assure a continual and increasing requirement for rice exports.

Although foreign market outlets will be primarily for conventionally milled rice, there is a growing interest in deep-milled rice. This is evidenced by the construction of plants in India for deep-milling operations, and by Japan's interest in using deep-milled rice for food products as well as the brewing of sake. The degree of whiteness of the rice served is a prestige factor in many countries.

Recent USDA-ARS research and development studies show that by controlled deep-milling of rice, two food products can be made: a high protein flour and the residual deep-milled head rice. The flour possesses unusually attractive nutritive properties for specific uses. The quality of the residual kernel is not materially affected for normal domestic uses and has an enhanced whiteness in appearance before and after cooking.

Standard processing techniques are used for the production of the new products. Highly nutritious rice flours can be made from whole milled rice, large broken kernels, solvent milled rice, or milled parboiled rice by the use of commercially available equipment.

CHARACTERISTIC PROPERTIES OF RICE PRODUCTS

Deep-milled rice flours of high protein content have been produced by abrading up to 15 percent by weight of the whole conventionally milled kernel. Removal of 5 to 8 percent by weight of the peripheral portion of long-grain rice appears to be optimal for superior cooking and processing characteristics of the residual grain.

A high protein rice flour prepared in the laboratory contained the following amounts of the constituents normally found in the conventionally milled rice:

ITEM	CONCENTRATION IN FLOUR 1/, 2/	APPROXIMATE CONCENTRATION FACTOR
Protein, percent	21.21	2.7
Riboflavin, mg./lb.	0.432	3.5
Niacin, mg./lb.	32.731	5.7
Thiamine, mg./lb.	2.851	7.7
Calcium, percent	0.262	11.4
Phosphorus, percent	0.804	5.7
Lipids, percent	3.59	15.6
Starch, percent	66.32	0.7
Amylose, percent	18.44	0.6

1/ Flour prepared from commercially milled long-grain rice, predominantly Bluebonnet 50, and represents 8 percent removal of the outer layers. All values listed are on dry-weight basis.

2/ Data taken from Normand, F. L., Soignet, D. M., Hogan, J. T., and Deobald, H. J. "Content of Certain Nutrients and Amino Acids Patterns in High Protein Rice Flour," Rice J. 69(8): 13-18 (1966). Values of riboflavin, niacin, thiamine on a mg./100g. basis are 0.095, 7.22, and 0.629, respectively.

No essential differences in amino acid pattern or content, except for a decrease in tryptophan, were noted in the flours over the original kernel. The high protein rice flours derived from the outer 5 to 8 percent of the rice grains show extremely low hot-paste viscosity.

After abrading away 5 to 8 percent of the conventionally milled grains, the remaining kernels are definitely whiter in color, expand to a greater volume when cooked, and display less tackiness than do the original kernels used in the deep-milling operations. Taste panels invariably rated the flavor of deep-milled rice as being better than that of the usual product. Kernels remaining after successive peripheral layers have been removed possess increasingly greater Brabender (hot paste) viscosities. Changes noted in the constituents of the rice kernels after deep milling include an increase in the starch and amylose content and a decrease in the protein, riboflavin, niacin, thiamine, calcium, phosphorus, and lipids content.

Rice is a preferred ingredient in the production of beer. Lipids and proteins are undesirable constituents for this use because they create "clouding" or "haze" and off-flavors. They also produce undesirable volatiles. Thus, the use of this process, particularly on broken rice, should result in a more attractive deep-milled product for the brewing industry.

USES

Rice protein has been listed among the best cereal proteins from a nutritional standpoint. The unique properties of the rice flours suggest their use in existing foods and food formulations. Additions to salad dressings, pastry mixes, potato pancake mixes, baby foods, gruels, cereal milks, geriatric foods, dietary foods, gravy mixes, and snack coating agents are examples of potential uses. Addition of rice improves the taste and properties of many food products. The

United Nations Children's Fund desires high protein rice foods for augmenting protein-deficient diets in rice-eating countries.

EQUIPMENT AND COSTS

It has been shown that commercial rice-whitening machines can be used successfully for the production of deep-milled rice. Exploratory tests conducted on a Satake rice-whitening machine[1/] show that in one pass 300 pounds of high protein flour per hour can be made from 10,000 pounds of white rice. The flour produced in a Satake unit, at 3 percent removal, will have a protein content ranging from 15 to 19 percent depending on the original protein content of the rice. By the use of several rice-whitening machines in series it is possible to remove 8 percent of the surface.

Preliminary estimates show that the cost for a 3 percent yield of flour would be about $2 per hundredweight and for an 8 percent yield, requiring the use of four Satake units in series, approximately $3 per hundredweight.

Numerous inquiries received by the Southern Utilization Research and Development Division for samples of the high protein flour and residual kernels indicate the rice industries and food processors' keen interest in the new rice products. Samples are available for extensive evaluation studies.

Procurement of information, reprints of articles, and samples of rice products can be made by contacting:

1/ Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S.Department of Agriculture or an endorsement by the Department over other products not mentioned.

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PUBLICATIONS[3/]

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Hogan, J. T. and Deobald, H. J., "Measurement of the Degree of Milling of Rice." Rice Jour. 68(9): 10, 12, 13 (1965) (SURDD Reprint No. 3001).

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Houston, D. F., Morgan, A. I., Jr., and Pence, J. W., "Rice Investigations at Western Regional Research Laboratory," Rice Jour. 69(7): 82-85 (1966) (WURDD Reprint No. 2303).

1/ A Laboratory of the Southern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

2/ A Laboratory of the Western Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

3/ Reprints may be requested by reprint number from the respective Divisions.